PATENT
Customer No. 22,852
Attorney Docket No. 04329.2306-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	)	
	)	
Yoshio Ozawa et al.	)	Group Art Unit: 2823
	)	
Application No.: 09/559,757	)	
	)	Examiner: Pham, Thanh V.
Filed: April 27, 2000	)	
	)	
For: METHOD OF MANUFACTURING A SEMICONDUCTOR DEVICE USING AN OXIDATION PROCESS	)	

Mail Stop Appeal Brief--Patents

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

REPLY BRIEF UNDER 37 C.F.R. § 41.41

Pursuant to 37 C.F.R. § 41.41, Appellants present this Reply to the Examiner's Answer mailed April 21, 2006. If any fees are required in connection with the filing of this paper, Appellants request that they be charged to Deposit Account No. 06-0916. A Request for Oral Hearing pursuant to 37 C.F.R. § 41.47(b) accompanies this Reply Brief.

REMARKS

I. Status of Rejections

In response to the Appeal Brief filed on February 6, 2006, the Examiner has maintained the rejection of claims 8-15, 20, and 21 under 35 U.S.C. § 103(a) as being unpatentable over Applicants' allegedly admitted prior art ("AAPA") in combination with Hisamune (U.S. Patent No. 6,414,352 B1) ("Hisamune"), Aminzadeh, et al. (U.S. Patent No. 6,707,120 B1) ("Aminzadeh"), and Wolf, et al. ("Silicon Processing for the VLSI Era," v.1, 1986, pp. 161-238) ("Wolf")

II. Response to Examiner's Arguments in the Answer

Appellants traverse the Examiner's rejection of claims 8-15, 20, and 21 under 35 U.S.C. § 103(a) and respectfully disagree with the assertions set forth in the Examiner's Answer for reasons discussed in their Appeal Brief. In addition, Appellants submit that the Examiner's rejection under 35 U.S.C. § 103(a) should be withdrawn for the following reasons.

As noted in Appellants' Appeal Brief, none of the applied prior art teaches or suggests the claimed step of "lowering a surface of the semiconductor substrate under a part of the insulating film [containing silicon and nitrogen]," as recited in independent claims 8 and 12. See Appellants' Brief at page 12, for example. The Examiner, in responding to Appellants arguments, apparently contends that a "bird's beak" is formed beneath silicon oxinitride film 95 in AAPA Fig. 15A because "there must be some degrees of swelling of bird's beak formation under many variable parameters such as the concentration of nitrogen

in the silicon nitroxide film ...[o]ther reasons could be list [sic] such as the heat applied when oxidation is not high enough ...." (emphasis added) Examiner's Answer at page 8. To the extent the Examiner's position is understood, the Examiner appears to make uncorroborated assertions that the process described in Appellants' specification must create a bird's beak under film 95 such that the substrate beneath this film is lowered. Such allegations, without citation to any support in AAPA whatsoever, are certainly without merit.

Moreover, the Examiner's assertions overlook express teachings regarding AAPA that no such bird's beak is formed. Namely, the specification, in discussing Fig. 15A, unambiguously states that "[w]hen...the concentration of nitrogen in the silicon oxinitride film 95 adjacent to the silicon substrate 91 is high, the bird's beak oxidation does not proceed." (emphasis added) Specification at page 21, lines 2-6. In addition, the specification teaches, with reference to Figs. 15A to 15C, that "[t]he silicon oxinitride film 95 present on the silicon substrate 91 prevents supply of an oxidizer to the substrate of the silicon substrate 91" (emphasis added). Specification at page 20, lines 24-26. Since silicon oxinitride film 95 obstructs the flow of oxidizer, substrate 91 beneath film 95 cannot be oxidized, and thus the surface of substrate 91 beneath film 95 is not lowered. Clearly, AAPA Fig. 15A and the corresponding description in Appellants' specification, teach that no bird's beak is formed, and thus the substrate is not lowered. Appellants fails to see how the Examiner's unsubstantiated statements could somehow negate the express teachings of AAPA.

The Examiner further apparently argues that AAPA suggests some minimal amount of bird's beak formation because "the term 'insufficient from the instant specification (not in the claims) does not provide a hundred percent insufficiency of the post-oxidation step in the process as a whole." Examiner's Answer at page 8. Appellants note, however, that the specification teaches that the amount of bird's beak oxidation is insufficient (see page 20, line 26 - page 21, line 1), not because a small amount of oxidation occurs, but because no such oxidation occurs at all (see above discussion). Thus, the Examiner's selective citations to AAPA in the Answer are taken out of context and are misleading.

In responding to Appellants' points that the cited portion of Hisamune (see Final Office Action mailed June 28, 2005, citing col. 2, lines 24-28) also fails to teach the claimed step of "lowering a surface of the semiconductor substrate under a part of the insulating film [containing silicon and nitrogen" (see Appeal Brief at page 13), the Examiner concedes that "it is agreed that 'the cited portion of Hisamune is silent as to an insulating film including silicon and nitrogen" because that part of the rejection concentrates on the sufficiency of post oxidation." Examiner's Answer at page 8. The Examiner nevertheless now appears to assert that another portion of Hisamune teaches the claimed "lowering a surface of the semiconductor substrate": "Appellant is directed to Hisamune col. 1, lines 22-44 wherein 'an oxide layer ... and a silicon nitride layer ...The LOCOS technique involves a bird's beak problem, which limits the scaling down of the cell array structure." (emphasis in original) Examiner's Answer at page 8.

A complete reading of the newly cited portion of Hisamune, however, reveals that the reference teaches "thermal oxidation" ... "[a]fter removing the portions of the silicon nitride layer." Col. 1, lines 39-42. Hisamune, however, does not specify what kind of thermal oxidation is used. Accordingly, the newly cited portion of Hisamune fails teach oxidation with ozone or oxygen radicals, as required by claims 8 and 12. Moreover, if anything, Hisamune teaches oxidizing portions of a substrate where a silicon nitride layer is removed, and thus certainly fails to teach applying oxidation with ozone or oxygen radical to lower a surface under a part of an insulating film containing silicon and nitrogen, as further required by claim 8 and 12.

Appellants further note that Hisamune expressly teaches a "nitride layer 102[, which] has an oxidation proof property that is effective in preventing oxygen radical from reaching a floating gate 201 and a transfer gate." Col. 4, lines 64-67. Thus, if anything, Hisamune teaches a silicon nitride film that blocks the flow of oxygen radicals. As such, in addition to reasons noted at pages 13 and 14 of Appellants' Brief, Hisamune necessarily teaches away from the claimed "lowering a surface of the semiconductor substrate under a part of the insulating film [containing silicon and nitrogen] ... by applying a thermal oxidation process ... using ... ozone [or] oxygen radicals." In light of such teachings away, Appellants respectfully submit that the Examiner has failed to consider Hisamune in its entirety and thus the rejection should be reversed for this additional reason. See MPEP §2141.02.

At page 9 of the Answer, the Examiner contends that "[t]he main idea of using the Hisamune reference is to against appellant's assertion of 'bird's beak oxidation owing to the post oxidation becomes insufficient.'" To the extent the Examiner's point is understood, Appellants note that, as discussed above, both Hisamune and AAPA disclose layers including silicon and nitrogen that prevent oxygen from reaching an underlying substrate, and thus both fail to teach or suggest "lowering the surface of the substrate" under a portion of an insulating film, as required by claims 8 and 12. The Examiner's assertions to the contrary are without merit, and contradict express teachings in Hisamune and AAPA.

Turning to Wolf, the Examiner cites to isolated teachings of thermal oxidation of a silicon substrate and remote plasma oxidation in the reference (see, for example, page 9, and page 11 of the Examiner's Answer). Such disparate teachings are presented in different chapters of the Wolf text book in a manner that in no way reference one another. In any event, the cited portions of Wolf are also silent as to the claimed "lowering the surface of the substrate under a part of the insulating film [containing silicon and nitride] ... by applying a thermal oxidation process ... using an oxidizing gas containing one of ozone and oxygen radicals." Wolf, therefore, fails to overcome the deficiencies of the other applied references discussed herein.

Finally, with respect to Aminzadeh et al., Appellants argued in their Brief that:

> The Examiner also contends that the claimed "lowering a surface of the semiconductor substrate" is "inherent as recognized by Aminzadeh et al., figs 2, 6 and the corresponding passages." Final Office Action at page 4. Figs. 2 and 6 of Aminzadeh, however, show substrate 101 (Fig. 2) and

> substrate 405 (Fig. 6) each having a *flat* surface. No portion of the surface of substrate 101 or substrate 405 is lowered relative to another portion. Moreover, the discussion of Fig. 2 at col. 1, line 56 to col. 2, line 5, and the discussion of Fig. 6 at col. 3, lines 65 to col. 4, line 43 are entirely silent as to any lowering of the substrate surface whatsoever. Appellants fail to see how such teachings disclose, inherently or otherwise, the claimed "lowering a surface of the semiconductor substrate *under a part of the insulating film* [containing silicon and nitrogen]" (emphasis added), as recited in claims 8 and 12.

Appellants' Brief at page 16.

In response, the Examiner contends that "it seems that appellant requires Aminzadeh et al.'s figs. 2 and 6 must be exact drawings of instant invention and ignores the argument/reason in the text of the references to be combined." Examiner's Answer at pages 9-10. In their Brief, however, Appellants did not rely on the drawings of Aminzadeh et al. alone, even though such drawings are sufficient to establish that the reference fails to teach the claimed lowering of a substrate surface. Rather, as noted above, Appellants also referred to portions of the specification of Aminzadeh et al. in support of their position.

In any event, the Examiner appears to allege that, in spite of the failure of the Ahminzadeh et al. to teach that the underlying substrate is consumed by oxide and thus lowered, "[m]ore oxide radicals ... being corporate [sic] into the insulating materials would swell the insulating layer, not only upward but also downward (because the combine with the substrate material)." Examiner's Answer at page 10, citing Fig. 3, page 202 of Wolf. As noted by the Examiner, however, Aminzadeh et al. discloses a re-oxidized nitrided oxide (RNO) process (see, for example, Aminzadeh et al. at col. 1, line 53 - col. 2, line 1 and the Answer at page 10), apparently in which a nitride film is subject to oxidation.

Such an RNO process is substantially different than the oxidation of a bare silicon substrate, as disclosed in the cited portion of Wolf, in which no nitride film is provided. The Examiner apparently attempts to draw parallels between the two processes in asserting that the underlying substrate would be consumed and oxidized in the RNO process in much the same way that it is consumed in the process shown in Wolf. The Examiner's analysis is flawed, however, simply because there is no disclosure or suggestion in either reference that the teachings of Wolf could somehow be applied to the unrelated RNO process disclosed in Ahminzadeh et al.

For example, in the RNO process, a nitride film, such as film 201 in Fig. 2 of Ahminzadeh et al., which includes silicon, is apparently provided on the surface of a substrate (e.g., substrate 101). During reoxidation of this film, the Examiner assumes that silicon in the substrate reacts with oxygen. Examiner's Answer at page 10. However, as noted above, this is not what Ahminzadeh teaches. In particular, the reference clearly discloses that film 201 increases in a "lateral" direction, not into the substrate. Col. 1, line 66 - col. 2, line 5. Clearly, if film 201 extended in a vertical direction into substrate 101, it would have been illustrated and described as such in much the same way that it is shown encroaching between gate electrode 202 and gate oxide 203. Accordingly, during reoxidation, silicon in film 201 is apparently consumed, not silicon in substrate 101. The irrelevant teachings of oxidation of a bare substrate in Wolf fail to suggest otherwise.

In sum, in light of the reasons discussed above in addition to those set forth in Appellants' Brief, none of the applied references teaches or suggests the claimed "lowering a surface of the semiconductor substrate under a part of the insulating film [containing silicon and nitrogen]," as recited in claims 8 and 12. These claims are thus allowable over the applied references and claims 9-11, 13-15, 20, and 21 are allowable at least due to their corresponding dependence from claims 8 and 12.

III. Conclusion

Accordingly, in view of the foregoing, Appellants respectfully request that the rejection be reversed and withdrawn.

Please grant any extensions of time required to enter this brief and charge any additional required fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW GARRETT & DUNNER, L.L.P.

Dated: June 15, 2006

By: _____
David L. Soltz
Reg. No. 34,731